Signature change in general relativity

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Errata

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In the formulae (18) of this paper an incorrect expression for the metric function $\omega$ was obtained since, as we have established recently, equation (17) is only valid for the pure vacuum case. The correct form of $\omega$ is the following:

$$
\begin{align*}
\omega &= -f^{-1}\left\{ iz A_0 + \sum_{n=1}^{4} \left[ i \left( 1 + \frac{\alpha_n}{r_n} \right) A_n \right. \\
&\phantom{=} \left. - \frac{m \tilde{B}_n}{(m + \alpha_n + i\alpha) r_n} - \frac{ib \Phi \tilde{B}_n}{(m + \alpha_n + i\alpha)^2 r_n} \right] - i(z + m) \right\}
\end{align*}
$$

where $B_n$ and $B_0$ (the latter does not enter into the expression for $\omega$) are solutions of the linear algebraic equations (10a)-(10e), in the first four of which the right-hand sides should be changed to $iz$, $-(a + i\alpha)$, $-i$ and $i\alpha$, respectively.

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In the second paragraph of section 4, due to a typesetting error, $l$ has been incorrectly used to denote the time coordinate. The time coordinate should be represented by $\lambda$. Thus the paragraph should read as follows.

Recall that the usual definition of proper time $\tau$ for a curve in $M_2$ is given by the line element, which gives $d\tau^2 = l^2 d\lambda^2$ for geodesics normal to $S$, where $\lambda$ is the time coordinate: $t - s = \theta/\partial \lambda$. It is desired to define an affine parameter $\tau$ which gives the usual definitions of proper time and distance in $M_2$ and $M_1$ respectively, and is continuous on $S$. The unique such definition is

$$
d\tau = \sqrt{\varepsilon l^2} \ d\lambda
$$

where the sign function $\varepsilon$ is given by

$$
\varepsilon = \begin{cases} 
-1 & \text{on } M_1 \\
0 & \text{on } S \\
1 & \text{on } M_2.
\end{cases}
$$

Equivalently, evolution derivatives are given by

$$
\mathcal{L}_{\varepsilon \tau} X = \sqrt{\varepsilon l^2} \dot{X}
$$

where $\dot{X} = dX/d\tau$. Then the field equations may be rewritten in terms of evolution respecting the affine parameter.